MATH 6: HANDOUT 14
GEOMETRY: RULER AND COMPASS, ORIGAMI

CONSTRUCTIONS: RULER AND COMPASS, ORIGAMI...

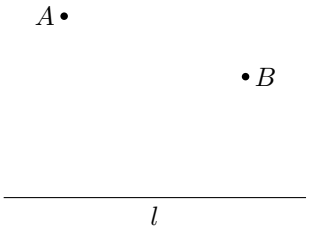
Today we discussed a quite different approach to geometric constructions: paper folding, or origami. Instead of using ruler and compass, we would be folding pieces of paper, starting with a square (or a rectangle). Attached pictures show how one can construct various figures such as equilateral triangles.

HOMEWORK

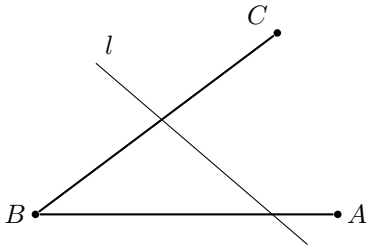
In the homework, the words "construct" or "find" mean "construct using ruler and compass."

How can you find the point on the railroad (line l in the figure below) which would be at equal distance from two villages (points A, B in the figure below)? [Hint: if this point is at equal distance from A, B, then one can draw a circle with center at this point which would go through A, B...)

1. How can you find the point on the railroad (line l in the figure below) which would be at equal distance from two villages (points A, B in the figure below)? [Hint: if this point is at equal distance from A, B, then one can draw a circle with center at this point which would go through $A, B\ldots$)

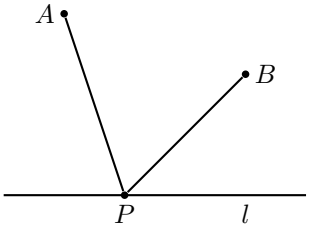


2. Given an angle $\angle ABC$ and a line l intersecting both sides of this angle, find a point P on l which would be at equal distance from the two sides of the angle (i.e., the two perpendiculars dropped from P to the sides of the angle would have the same length).



3. Given a triangle $\triangle ABC$, construct inside it a point which would be at equal distance from all three vertices of the triangle.

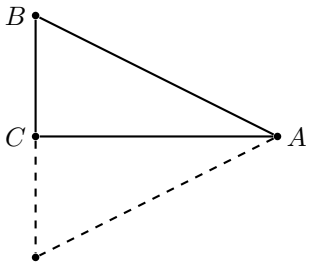
4. The figure below shows two villages A and B. A horseman starts at village A, goes to the river (line l in the figure) to let the horse drink, then goes to village B. How should he choose the point P on the river to make his trip as short as possible?



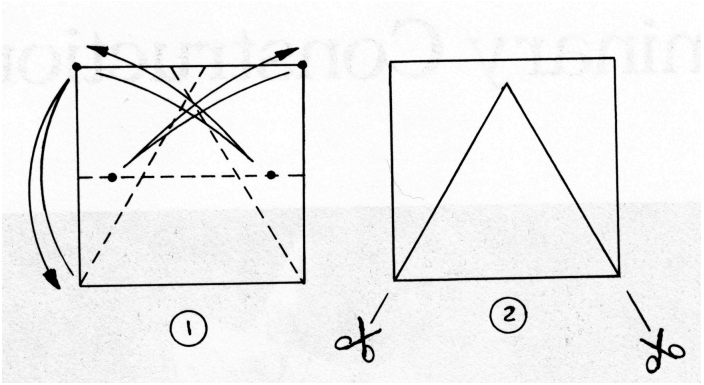
5. Given a square sheet of paper, find its center by folding.

6. Given a paper triangle, find the center of inscribed circle by folding.

7. (a) Let ABC be a right triangle in which one of the legs is exactly $1/2$ of the hypotenuse: $BC = \frac{1}{2}AB$. What are the angles of such a triangle? (*Hint*: if you put two such triangles together, as indicated by the dotted line, what triangle do we get?)

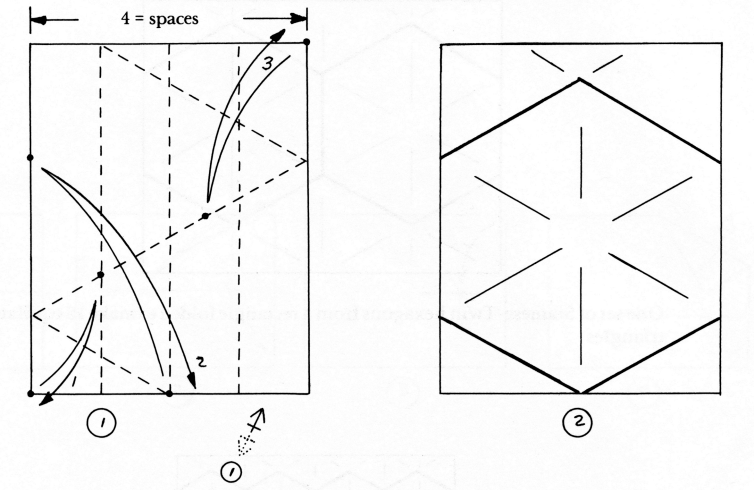


(b) The attached figure shows how you can construct an equilateral triangle from a square by folding. Can you explain why it does indeed give an equilateral triangle? Construct one and check.



*(c) How you can construct an equilateral triangle from a rectangle (by folding)?

8. The attached figure shows how one can make a regular hexagon from a rectangular piece of paper. Can you explain why this does give a regular hexagon? Make one and check that it is indeed regular.



(funny double arrow below the first figure means "turn over and repeat step 1").

9. The figure below shows a rectangle divided into several pieces. Which of the two rectangles, A or B, has larger area?